

[54] PORTABLE CRYOSURGICAL APPARATUS

[76] Inventor: Theodore A. Tromovitch, 1667
Escalante Way, Burlingame, Calif.
94010

[22] Filed: Sept. 15, 1972

[21] Appl. No.: 289,753

[52] U.S. Cl. 128/303.1, 222/382, 222/383,
222/397, 222/538

[51] Int. Cl. A61b 17/36, B67d 5/40

[58] Field of Search B67d/5/54; 128/303.1;
222/397, 398, 382, 383, 538

[56] References Cited

UNITED STATES PATENTS

367,474	8/1887	Truman	222/538 X
494,467	3/1893	Donathen	222/397 X
1,009,980	11/1911	Leisure et al.	222/397
1,651,256	11/1927	Davis	222/397

3,485,060	12/1969	Ziegler	128/303.1 X
3,630,203	12/1971	Sellinger et al.	128/303.1
3,651,813	3/1972	Bryne	128/303.1

FOREIGN PATENTS OR APPLICATIONS

372,392 2/1907 France 222/397

OTHER PUBLICATIONS

Marshall, Principles and Practice of Operative Dentistry, pp. 578-580. J. B. Lippincott Co., Philadelphia and London, 1901.

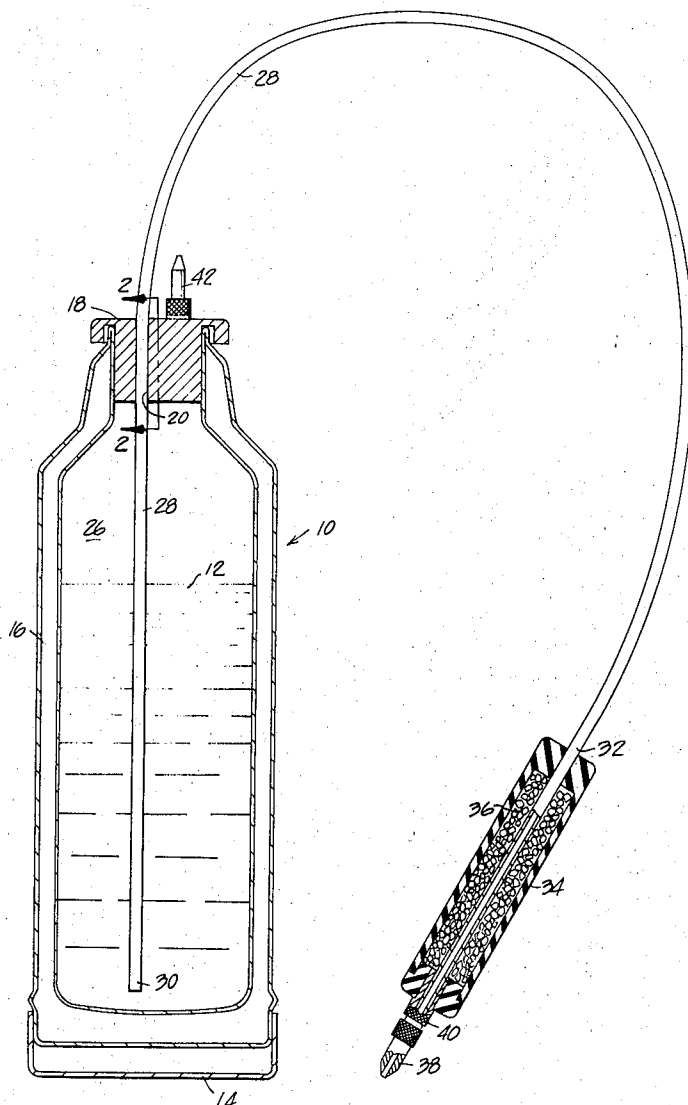
Primary Examiner—Channing L. Pace

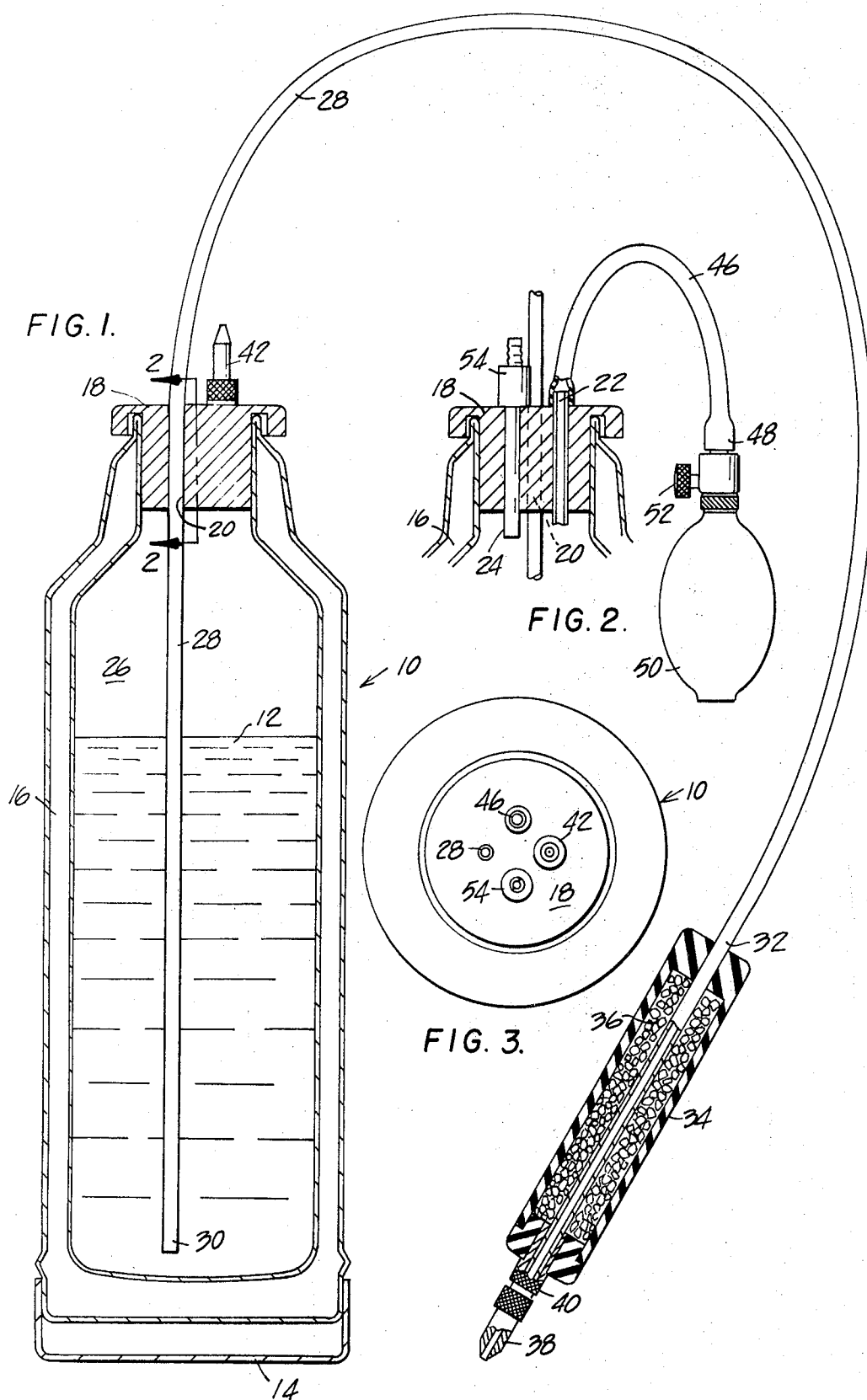
Attorney, Agent, or Firm—Robert Charles Hill

[57] ABSTRACT

This invention relates to cryosurgery, and more particularly to the delivery and application of liquified gas coolant to living tissue in order to necrotize the same.

2 Claims, 3 Drawing Figures





PORTABLE CRYOSURGICAL APPARATUS

BACKGROUND OF THE INVENTION

It has long been known in the prior art to use liquified gas (such as helium, nitrogen, oxygen, air, freon, zeron, carbon dioxide, etc.) to freeze healthy or diseased tissue, and thereby necrotize the tissue. For instance, one well-known use of liquified gas in cryosurgery is the removal of lesions, both on the skin and internally. Usually, the object is to remove the lesion by destroying the tissue; in other cases, the object is the destruction of the tissue while maintaining adjacent portions of the tissue structure in place, such as in the walls of vital organs. As used herein, "lesion" means diseased tissue which is to be frozen; the destruction of lesions includes removal of tissue for cosmetic purposes, and killing of tissues as a complimentary modality to surgical procedures.

However, prior art devices have been very inefficient due to very poor or lack of insulation in the containers holding the cryogenic liquid with the result that ambient heat prematurely gasifies the cryogenic liquid and same is vented to atmosphere through safety exhaust means, etc. A further drawback of prior art devices resides in their awkward construction whereby the container holding the cryogenic liquid is oftentimes integrally associated with the discharge nozzle for the cryogenic fluid. In many cases such a construction leads to severe operator fatigue and also hampers the use of the apparatus since only one hand is free to operate the surgical device while the operator's other hand is occupied with the holding of the container or the operation of levers, etc. A still further disadvantage of some prior art devices is that they include 17 liter or 30 liter tanks which contain the coolant, thus making the structure heavy and cumbersome and almost impossible to transport for house calls and/or visits to nursing homes and hospitals.

Accordingly, it is the primary object of the present invention to provide improved cryosurgical apparatus in which the cryogenic liquid is contained in a completely insulated container and which is normally not vented to atmosphere.

A further object of the invention is to provide apparatus which does not require the use of a finger or foot-operated lever, etc., during actual surgical use of the device.

A further object of the invention is the provision of a simple manually operated fluid pressure producing device for selectively applying pressure to the cryogenic fluid in the container for delivery of same to the outlet nozzle.

A still further object is to provide a small self-contained hand carryable apparatus which is readily portable.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partially sectioned, broken away side elevation view of the preferred embodiment of the present invention;

FIG. 2 is a partially sectioned, broken away side view of the device shown in FIG. 1 when rotated 90° to illustrate additional features of the invention; and

FIG. 3 is a top plan view of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, there is illustrated a cryogenic system including a supply container 10 having a suitable cryogenic liquid 12 contained therein. The container 10 comprises a base member 14 into which is seated an insulated bottle 16 which is preferably a double walled vacuum bottle.

The cryogenic liquid 12 may be any nonexplosive, nontoxic, low molecular weight substance. Of those substances meeting the aforementioned requirements, the choice of liquid will depend upon the temperature at which the surgeon or dermatologist chooses to perform the operation. For most applications the preferred substance is liquid nitrogen.

The top of the insulated bottle 16 is provided with a removable closure 18 which engages the bottle in fluid tight relation as shown in the drawing. As best shown in FIG. 2, the closure 18 is provided with three tubular orifices 20, 22 and 24 extending therethrough for communication with a chamber 26 defined by the insulated bottle 16.

Extending through the orifice 20 is a tubing 28, preferably of nylon, having a first end 30 submerged below the level of the cryogenic liquid 12. Near the second or remote end 32 of tubing 28 there is provided insulated handle means 34. A desirable material for the thermally insulative handle 34 comprises plastic layers, such as polystyrene, superimposed upon one another and then heated and joined in a vacuum chamber. Such materials exhibit very poor thermal conductivity and also have great tensile strength. In addition, insulative materials as shown at 36 may be placed between the handle 34 and tube end 32 as desired.

At the remote end 32 of the tubing 28 there is provided a nozzle means 38 which is removably connected to a shank 40 formed in the outer end of handle 34 and into which the end 32 of tubing 28 terminates. The shank 40 may receive any one of several nozzles, such as by a threaded connection, and as shown in FIGS. 1 and 3 an auxiliary nozzle 42 may be stored on a shank formed on the top of closure 18. All such nozzles may be regulated in a known fashion, such as by rotating same, from a completely closed position to a fine mist-like spray or a small diameter highly localized stream.

A desirable feature of the invention resides in the provision of the relatively long and flexible tubing 28, which in conjunction with the insulated container 10 allows the operator maximum mobility and flexibility without having to move the container 10 during operation. Some operative functions of subject cryogenic devices require the use of both of the operator's hands for considerable periods of time and it is obvious that excessive weight or awkwardness caused by having to move the liquid container during operation is not desirable.

Referring back to FIG. 2, it may be observed that a second flexible tubing 46 communicates through closure orifice 22 with the space located in chamber 26 above the level of cryogenic liquid 12. The outer end 48 of tube 46 is suitably attached to a conventional air bulb 50. The air bulb is used to selectively apply pressure to the space in chamber 26 located above the level of cryogenic liquid 12. A suitable valve means 52, such

as a screw valve, may be employed to close off the air bulb 50 when same is not in use.

As also shown in FIG. 2, there is provided safety valve means 54 formed on the closure 18 and in communication with closure orifice 24 which orifice is in communication with the space in chamber 26 located above the level of cryogenic liquid 12. The safety valve 54 is set to open at any given pressure above the normal pressure maintained in chamber 26 of container 10. For example, the valve may be set to open at any time the pressure in chamber 26 rises three pounds above normal pressure in said chamber, such for example as when pressure is being applied to said chamber from the air bulb 50 and exceeds the desired level. FIG. 3 illustrates the relative positions on the enclosure 18 of tubing 28, tubing 46, auxiliary nozzle 42, and safety valve means 54.

During operation of the device of the present invention, the container 10 is filled with liquified gas coolant, such as liquid nitrogen, to a suitable level. The operator then directs the nozzle 38 toward the tissue and, after opening valve 52, administers pressure to the chamber 26 above the level of cryogenic liquid 12 by squeezing air bulb 50. This pressure forces the liquid nitrogen 12 into delivery tube 28 and through nozzle 38. The length of delivery tube 28 can be selected such that by the time the cryogenic fluid reaches the outlet orifice of nozzle 38, it comprises a desired gas-liquid ratio, such as, for example, 90 percent gas and 10 percent liquid. It should also be understood that the duration of use also influences the gas-liquid ratio. Thus, the longer the continuous use, the greater the percentage of liquid flowing through nozzle 38. Typical usages vary from five seconds up to and including several minutes. If at any time during operation of the device the pressure in chamber 26 exceeds the desired level, the pressure safety valve 54 will open and vent the chamber to at-

mosphere until such time as conditions have stabilized.

It can therefore be seen that the new and improved cryosurgical apparatus of the present invention provides a portable self-contained unit which is easy to operate in a manner that maximizes the effective use of the coolant.

What is claimed is:

1. A portable cryosurgical instrument comprising:
 - insulated container means having an upper end and a lower end; 'a quantity of cryogenic liquid within said container means having an upper level;
 - removable closure means sealably engaging the upper end of said container means;
 - first tubular means extending through said closure means and having one end thereof communicating with said cryogenic liquid below the upper level thereof for selectively transferring said liquid from said container to a spray nozzle means located at the other end of said first tubular means;
 - means for selectively administering pressure through said closure means to the upper level of said cryogenic liquid to force said liquid through said first tubular means;
 - direct response safety valve means on said closure means for venting said container to atmosphere when the pressure therein exceeds a predetermined level; and
 - insulated handle means on said other end of said first tubular means near said nozzle means;
 - whereby effective use is made of said cryogenic liquid so that numerous patients may be treated at different locations on one fill of cryogenic liquid.
2. The portable cryosurgical instrument of claim 1 additionally comprising spray nozzle storage means on said container closure means.

* * * * *

40

45

50

55

60

65